COMMONWEALTH OF PENNSYLVANIA.

STATE BOARD OF HEALTH.

REPORT OF DR. W. F. ELGIN

OF INSPECTION OF

VACCINE PROPAGATING ESTABLISHMENTS

IN EUROPE.

(Extracted From the Twentieth Annual Report of the State Board of Health.)

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Glenolden, Pa., January 13, 1904.

Dr. Benjamin Lee, Secretary State Health Board, Philadelphia, Pa.:

Dear Sir: In February last, I received an appointment through you as a special Commissioner of the State Board of Health of Pennsylvania authorized to make an inspection of the various vaccine establishments in Europe and report findings. The inspection was finished the latter part of last Spring but from the stress of other duties in connection with the laboratory, and because of the time required for the translation and arrangement of a number of papers, obtained at the various places visited, on subjects relating to vaccine, it was found impossible up to the present time to complete the report.

I have the pleasure of transmitting herewith the results of a detailed inspection of ten vaccine laboratories in Europe, distributed as follows: One in London; two in France; one in Brussels; three in Germany; two in Switzerland, and one in Italy.

I am glad to say that my reception as your representative was especially cordial and that every courtesy was shown me by the several directors who gave me all the information at their disposal in reference to methods, results, etc., in the preparation of their vaccine.

Since a detailed description in each instance is herewith transmitted, it will be inexpedient to further discuss the matter here. It may not be inappropriate, however, to call attention in a general way to some of the special features noted and draw a parallel with the methods in vogue in this country.

Attention will first be called to certain features of the work practically common to all the laboratories visited.

First. Glycerinated vaccine only is prepared. No question is raised as to the expediency or advisability of dried vaccine in any form for general distribution. The only exception noted is in Paris where the special "calf to arm" method is largely practiced.

Second. Vaccine establishments are chiefly operated by the government or under government control.

Third. The methods of distributing the virus are usually confined to one or two varieties of package, easily manipulated and costing comparatively little in preparation.

Fourth. With one or two exceptions, little attention is paid to the bacteriological examination of the virus. It is claimed that if the vaccine is kept a certain length of time (varying from ten days to two months), that the glycerin so far protects it as to insure against accident from any contained non-spore-forming organisms.

Fifth. As a rule small calves weighing from 200 to 400 pounds are used.

As has been stated, the foregoing are more or less common to every place visited. It is worthy of note, however, that every propagator has his peculiar method, or more properly speaking, his special feature without the employment of which he claims it practically impossible to produce reliable vaccine.

In one place this takes the form of retrovaccination; in another, vaccine is passed through the rabbit; another has a special way of vaccinating; while still another uses for seed especially selected vesicles; and so on.

This would seem to indicate that while certain well-known principles are generally accepted by investigators abroad, yet the question of producing vaccine according to known laws and absolute methods is still a long way from being solved.

The conditions that obtain in Europe differ materially from those of the United States.

First. There is a larger number of vaccine plants and consequently the area to be covered by each is smaller, which naturally shortens the time from the issuance of the vaccine to the use of the same. In Germany there are twenty-two vaccine laboratories and 50,000,000 inhabitants. Here we have, as you probably already know from examining the report, the most exceptionally gratifying results from vaccination that have been obtained anywhere in the world with the possible exception of Japan.

Second. The vaccine is usually shipped direct to the doctor who expects to use it, upon an order to the laboratory; while in this country conditions require that vaccine pass through the wholesale and retail drug trade before it reaches the consumer.

Third. In Europe it is not the custom to date vaccine, but usually a notice accompanies the package, to use the virus as soon after its receipt as possible, while trade conditions in the United States are such that a given date must be placed on each package to indicate the time of exchange for fresh vaccine, and the vaccine is supposed to remain active to this date; which fact is only an assumption on the part of the propagator. With as much precision could he foretell the death of a person. You can therefore see the absurdity of this plan from a scientific standpoint.

Fourth. In Europe the temperature rarely exceeds 80 degrees F.

(with the possible exception of Rome), even in summer; and it not infrequently happens that, on account of the thorough enforcement of the vaccination laws, virus is not required during the extreme hot weather, so that a number of institutions, particularly in Germany, do not issue vaccine at this season.

I deemed it of especial importance to discover some method to insure the activity of the virus during the heated term, such as we experience in the United States in August and September. Practically no information on this line could be secured since as has already been noted, conditions on the Continent differ materially from those encountered here, where experience teaches us that vaccine produced in a hot climate, and shipped in a heated temperature is conspicuously unreliable and untrustworthy as to the time it will remain active and give the expected results.

You, I am sure, realize the importance of this to a health officer when fighting small-pox in the summer months. The only possible surety, I can at present suggest, is to issue and use the virus as soon after collection from the animal as possible.

Attention has already been called to the fact that but little routine bacteriological work on subjects connected with vaccine is done in Continental laboratories. In this country the leading propagators have been trying to produce virus, not only active but at the same time free from extraneous germ life.

We were taught to believe this possible from the work of Monckton Copeman first published in 1891 and followed later by other papers until the publication of his Gilroy lectures in 1896. Such brilliant results were expected from this, that investigators in the United States took up the work with great enthusiasm.

Attention is called to the fact that glycerin was used in Europe a long time prior to this, in a number of institutions, but as a preservative of vaccine rather than a destroyer of extraneous germ life. After this publication of Copeman's however, the ruling idea among the propagators of this country seemed to strive more for bacteriological purity than for physiological activity.

The result of holding vaccine in the laboratory until it is practically clear of germ life or until some crucial test had determined the germs non-pathogenic was productive, in the summer time particularly, of numerous failures and consequent disastrous results both to the vaccinated and to the producer; when persons (who having been exposed to small-pox) would have been protected by an active vaccine, found themselves in the clutches of this dread disease.

This conditions of affairs has probably been enhanced by the investigations and publications of reports, of several well known

bacteriologists on their findings in the vaccine of various producers. In these reports so far as my knowledge goes the bacteriological side largely is considered and the influence of temperate upon glycerinated vaccine and its reliability from the standpoint of producing a typical vesicle is lost sight of.

Permit me to say in this connection that a long experience has demonstrated to me the impossibility of studying vaccine from the bacteriological standpoint alone. The conditions found at one period differ so vastly from those found at another, that no one can arrive at logical results save by investigations extending from year to year under all conditions, temperature, etc., looking not only to the bacteriological but to the physiological aspect as well.

During the Summer and Fall so much uncertainty existed as to the reliability of the glycerinated virus, that in a number of instances the cry has gone up for return to the old dry ivory point with all the unreliability and danger connected with its use. At least one prominent medical journal has had one or two editorials along this line and a number of health officers and physicians have expressed themselves hostile to the use of glycerinated vaccine for reasons already noted. This can the more easily be understood, since the usual custom has been to charge these points direct from the calf so that they are frequently in the hands of the consumer and used long before the glycerinated vaccine has left the laboratory. That, however, the latter is the more reliable in every way, is undoubtedly true; since I have had occasion to make tests, a number of times with the two kinds of virus taken from the same animal and subjected to the same conditions, in which the results were practically always in favor of the glycerinated virus. It remaining active by a good margin longer than the dry point.

One Word in Reference to "Government Supervision."

Abroad, as has already been noted, most laboratories are owned or supervised by the government; yet a large amount of discretion is allowed the directors. The instructions are very general in character where the production of virus is concerned but very rigid in the requirements as to its use by the vaccinators. We have just entered on an era of government control, and licenses were issued to the producers in August last. Up to the present time, however, an inspection of premises and enforcement of cleanliness in the production of virus seems to be as far as the government proposes to go; and in fact I cannot see how a much more advanced position can be taken with our present knowledge on the subject of vaccine.

Since my return from abroad, I have had several letters and pub-

lications from Drs. Blaxall and Greene, of the London Government Laboratories, in relation to experimental work and particularly describing Dr. Green's method of the rapid purification of vaccine by the use of chloroform.

We have made exhaustive experiments by the method as suggested above.

At the suggestion of Dr. J. J. Kinyoun, and with his assistance and advice, the Japanese method instituted by Kitasato and at present employed by Umeno, director of the Japanese government vaccine institute, has been largely experimented with. This consists of the dilution of the virus with a small percentage of carbolic acid. The results obtained by this method have been more satisfactory than with the chloroform method. The matter, however is still in the experimental stage; and may not be practical under present conditions in the United States.

I must ask your pardon for the length of this communication and can only plead in extenuation, the importance of the subject treated upon both to yourself and all health officers in general.

I have tried to give an unbiased and strict description of the methods abroad; and in this communication, I have drawn conclusions and touched upon other subjects that appear to me to be of vital importance, in connection with vaccination.

I have in my possession, documents dealing with special aspects of the subject, such as the government regulations in Germany, etc., which I will be glad to submit for your inspection if you so desire.

Anything further that I can do for you will be done with pleasure.

Fraternally yours

W. F. ELGIN.

GREAT BRITAIN.

Inspection of the Vaccine Department of the Local Government Board. The Stables are Located at No. 59 Lambs Conduit Street. Dr. F. R. Blaxall, Director, Assisted by Drs. Greene and Fremlin.

The building is old and consists of an operating room, also used for human vaccination; operating room No. 2; office, and at the extreme back, the stable for calves. The building is but poorly adapted for the use for which it is intended. The ceilings are low, light poor, and vetilation none of the best. Dr. Blaxall stated that the Government contemplates erecting new and commodious buildings in the near future.

The operating table is of the ordinary tilting variety, the only improvement noted is a grating in the bottom and an arrangement for carrying off the drainage. The animal is strapped to the table on its left side, the front feet fastened together and the hind feet at right angles, exposing the abdominal region and the anterior thighs.

A surface a little over one foot square and varying in size according to the body weight of the animal, is shaved, washed with soap and water, then sterilized water and carefully dried with sterilized towels. With an ordinary lancet, linear incisions are made in the long axis of the animal, about one inch apart. Little attention is paid to the depth of the incision, though but little blood is drawn. The virus is now applied with an ivory spatula (somewhat resembling the American "seed spade"), which is first dipped into a receptacle holding the seed virus, then with the spatula the virus is picked separately into each incision. None is applied between the lines.

The animal is now removed to the incubation stable which differs little from an ordinary cow stable except in the size of the stalls. It has a cement floor with a gutter at the back of the animal. The calves are fastened by means of a head halter and ring to an upright iron bar; thus they are permitted to lie down or stand up at pleasure. Straw is used for bedding and they are allowed to nibble at hay placed conveniently in a rack. Otherwise they are fed on milk, chaff, and crushed oats.

After one hundred and twenty hours (sometimes earlier according to the rapidity of the development of the vesicle), the animal is re-

turned to the operating room, strapped to the table, the vaccinated area washed with sterile water, the vesicles and contents removed with a Volkman spoon or curette, and the material placed in a glass stoppered bottle of known weight. This material is immediately transferred to the Jenner Institute of Preventive Medicine for treatment.

The vaccine department of the Local Government Board has here several rooms for the preparation of vaccine virus from the crude pulp, as well as for general research work. The virus is triturated in conjunction with a 50 per cent. glycerin and water solution by passing it several times through Dr. Blaxall's modification of the Chalybäas mill. The product when finished being one part pulp, to from four to six parts of the glycerin and water mixture. After grinding, the material is put into tubes holding from five to ten c. c. each. These are corked, paraffined, placed in cold storage and kept at a temperature of ten degrees C. until ready for issuance.

In the meantime, the vaccine is tested on calves and children, usually the latter since Dr. Blaxall believes that calves are unreliable as tests. A bacteriological test is also made once each week to determine the character of the organisms present and the rapidity of the elimination of the same by the action of the glycerin. This elimination is practically accomplished in from four to six weeks; when the virus is put up into capillary tubes, each holding sufficient for one vaccination; and in small round bottom capsules each containing from ten to twenty-five vaccinations.

Methods Peculiar to this Laboratory and Regarded by Dr. Blaxall as Essential to the Successful Production of Vaccine:

Dr. Blaxall does not believe in the deterioration of the lymph by passing it continuously through calves; nor in its rejuvenation by means of retrovaccination, or subsequently passing it through the human. He suggested that he was developing a method for improving poor specimens of virus, but did not indicate his procedure.

He believes that seed vaccine should be of especially selected vesicles taken about three months before it is used for this purpose.

He states that advanced lymphs are especially unreliable (by this, he means vaccine that has developed too rapidly on the animal).

He has tried rabbits as tests for vaccine but found them unreliable.

Dr. Blaxall believes that care should be taken not to overvaccinate an animal (this means not to use too large a surface in proportion to the body weight). Virus obtained from such an animal is unreliable. Each calf yields from ten to twenty grams of pulp.

Each animal is slaughtered after the removal of the virus and a certificate as to its physical condition submitted by a competent veterinarian.

Dr. Blaxall and his assistant make very thorough bacteriological examinations. The bacteria found consist of the various staphylococci and occasionally the Bacillus Mesentericus. No streptococci are noted. No lymph is rejected on account of contaminations since pathogenic organisms are never persistent in glycerinated vaccine.

No anaerobic tests are made since Dr. Blaxall and Dr. Fremlin do not believe anaerobes are ever found in vaccine produced after this method.

FRANCE.

Inspection of Institute Pasteur de Lille. March 16, 1903, Director M. Calmette, Assistant M. Guerin.

The building of Institute Pasteur de Lille are new and finely adapted to laboratory purposes. M. Calmette not only produces vaccine here, but the various antitoxins as well. He also does certain chemical and physical laboratory work, particularly in reference to water, sewerage, and kindred municipal health subjects in which the town of Lille is interested.

Vaccine Stables. At the back of the main building and across a court was a commodious brick building containing several ordinary stalls for larger animals. In the stalls, I noted two calves from which the virus had been removed on Friday, March 13. An examination revealed the fact, that the redeveloped vesicles were such as we would expect three days after removal of virus from a good take.

The animals stood in ordinary stalls, bedded with straw; and there were no especial arrangements to protect against contamination.

A second stable, separated from the first, was inspected. In this was a half-dozen animals undergoing the tuberculin test preparatory to vaccination. This test is made eight days before the animals are used.

Character of the Animals. The calves used by M. Calmette are from two to three years old, in good condition, preferably female, weighing from 400 to 700 pounds and having a deep dark red skin. Attention is called to this fact, because in examining the virus, I was lead to believe from its color, that it contained blood. M. Cal-

mette assured me this was not due so much to blood as to the deep color of the pigment cells removed with the virus.

The animals are fed on hay, "paralla," and a peculiar kind of cake made from flaxseed meal and baked.

The animals are killed subsequently to the removal of the virus and an autopsy made. If the report is favorable, the flesh is used for food.

Operating Room. The operating room consists of an ordinary shed adjoining the stable. This room has a brick floor. For throwing the animal, a large tackle with the necessary rings, etc., such as is used in veterinary practice, is fastened to the side of the building, the rings being imbedded in the floor. By means of this the calf is thrown in a favorable position to expose the proper field of operation. The nose is secured by a clamp, held by an assistant; to keep the animal from struggling. The surface between the thighs around the udder, and forward to just behind the front legs is now shaved, washed with warm water, and dried with sterilized towels. Linear incisions are made in the long axis of the animal, about four or five centimeters in length and two centimeters apart. These are made very superficial with an arrow pointed bistoury. A slight amount of bleeding was noted. The seed vaccine prepared from rabbits (after a manner to be hereinafter described), is rubbed into each incision with a blunt spatula. After the surface is vaccinated, it is protected from outside contaminations by a cotton apron which is changed twice daily (according to M. Calmette). After vaccina- the animal is removed to the stable where it remains for "six times twenty-four hours," never less.

At the end of this time it is returned to the operating room, the surface cleansed, the pulp removed with a curette, and then transferred to a glass receptiele, previously sterilized. The virus is covered with glycerin in the proportion of 50 parts pulp to 100 parts glycerin. This is put away without grinding for one month or longer. Just prior to issuance it is ground in a Chalybaas mill, after which it is put into capillary tubes holding five vaccinations each.

Methods Peculiar to this Laboratory and Regarded by M. Calmette As Essential to the Successful Production of Vaccine.

M. Calmette does not believe that retrovaccination is necessary to prevent the deterioration of a strain of lymph, but says that this can be accomplished by the passage of the virus from rabbits to calves and vice versa, instead of through the human.

His method is as follows: A rabbit weighing at least 2,000 grams, in good condition, of white or light red skin as near smooth as pos-

sible, is shaved on the back and the seed vaccine from especially selected vesicles on a calf (removed about one month previous), is rubbed over the surface without any scarification. The rabbit is returned to the cage for four days, when the surface is found to be filled with fine large rather dry but typical vesicles. These develope more rapidly on the rabbit than on the calf or human being. The animal is killed, the virus scraped off, and the product from five or six rabbits rubbed up with glycerin and used immediately to vaccinate one calf. M. Calmette believes that by this procedure not only the integrity of the virus is maintained without attenuation, but at the same time the germs of the "cocci" group are rendered practically harmless by passing through the rabbit and back to the calf.

M. Calmette sometimes adds an additional proportion of glycerin when filling the vaccine into capillary tubes, if he finds the pulp too thick.

Bacteriological tests of the virus are no longer used, since M. Calmette considers them useless, and incapable of "supplying any indication of the virulence of the vaccine."

During the purifying period, the vaccine is kept at from 3 to 5 degrees C.

The physiological activity of the virus is determined by testing a sample of each lot before distribution.

M. Calmette stated that numerous bacteriological examinations have demonstrated the presence of the various staphylicocci. No streptococci have ever been noted.

Anaerobic tests are not employed since no tetanus has been known to result from vaccination.

No vaccine is produced from June 1, to September 1, thus avoiding the summer heat. Should it be necessary to make vaccine during this season, the stables would be cooled with ice.

The laboratory and equipment together with Dr. Calmette's world-wide reputation guarantee a carefully prepared virus; nevertheless I was not favorably impressed with the condition of the stable nor the surroundings of the animal during the period of incubation.

Inspection of Institute Vaccine Animals. No. 8 Rue Ballu, Paris.
Directors: E. Chambon and St. Yves Menard.

This is a private institution founded by E. Chambon, one of the present directors, in 1864 shortly after the adjournment of the Congress at Lyons where the possibility of transmitting syphillis by means of humanized lymph was demonstrated.

The building contains two offices, a reception room, a room for human vaccination (where patients are received and vaccinated direct from the calf), an operating room, a stable having a concrete floor corrugated in blocks and containing ten stalls of wood, and a second room adjoining the stable, also having concrete floor, to which the calves are taken during daily cleaning of the stable. Back of this and connected therewith by a common covered passageway is a horse stable and accommodation for vans used for transferring calves to the various sections of the city for "calf to arm" vaccination.

Animals. The animals are of the Limosin breed and taken from a district of that name. These are selected because of their hardy and healthy habits. They are brought direct from the district to the receiving stable on "Mont Martre" where they are kept under observation until required for use at the Institute. The animals which are from four to five months old are fed on hay, bran, and oats. These are preferred to the younger animals because, not having been fed on milk, change of food does not subject them to diarrhoeal troubles to such an extent.

They are shaved on the right side from just back of the front shoulder to the hip, and well down on the abdomen to the median-line. The surface is washed first, with soap and water, then with saturated solution of boracic acid and dried with sterilized towels. Over this surface incisions are made about 2 centimeters long and from 4 to 4½ centimeters distant froim each other. Each row is set "quincuncial," the incisions being made crosswise instead of in the long axis of the animal. A special lancet is used for this purpose, carrying two blades of the same length and width but about one millimeter apart. Occasionally three and even five blades are used. The virus is worked into each incision separately with a blunt lancet. The seed is the ordinary glycerinated vaccine of assured activity and from one to two months old.

The animal during this process is strapped to a tilting table on its left side. When the right side is finished, the other is vaccinated; but this is done with the animal standing up and not so large an area is inoculated.

The animal is now transferred to the incubation stable where it is kept under observation for four, five or six days. It is bedded with straw and allowed to nibble hay. It is otherwise fed as before mentioned.

The stable is given a thorough cleaning as before noted, each day, the animals in the meantime having been removed to the adjoining shed.

After the animal has been in the stable for four days, if it is re-

quired for direct calf to arm vaccination, one or more vesicles as may be needed are used for this purpose and the same process is repeated after five and six days, if necessary; still other vesicles being used. Should any virus remain undisturbed on the animal at the end of six days, it is used for the preparation of glycerinated virus. The surface is first washed with soap and water, a profuse lather being made with a shaving brush to remove any foreign matter or scab that may be present it is then flushed with sterilized water and dried with sterilized towels.

The vesicles and contents are scraped off with a curette, covered with an equal quantity of glycerin (estimated) and placed in cold storage until issuance. When required, this material is ground in a Chalybaas mill, forced through a seive for the removal of unground pulp, hairs, etc., and then put into capillary tubes about 2 mm. in diameter, holding four vaccinations each. Twenty vaccination tubes are also used.

Methods Peculiar to this Laboratory and Regarded by Dr. Chambon as Essential to the Successful Production of Vaccine.

Dr. Chambon's method of inoculating animals differs from any I encountered elsewhere, in that the incision are made crosswise instead of linear.

Mention has been made of the "calf to arm" vaccination. This is peculiar to Paris and a more detailed account may be interesting. The city is divided into twenty wards or districts. A period for public vaccination is appointed once a week to each one, at a stated place.

When a visitation is to be made, a large closed van is taken out, a calf with well developed vesicles aged four, five or six days, is loaded in, one of the doctors on the staff of the vaccine laboratory accompanies the van and they are driven rapidly to the point where the vaccination is to be performed. Having arrived, the calf is unloaded, one or more vesicles carefully cleaned, the scab removed, the vesicle gripped below the base with a special pincer (Chambon pattern), and with a sterilized lancet the vesicle is scraped. The lancet thus charged is passed to the vaccinator who vaccinates the patient by the insertion method, and drops the lancet into a vessel containing a solution of Mercuric Cyanide. A number of lancets are found necessary for the work and when all have been used, they are taken out of the solution, cleaned, and recharged as required.

Dr. Chambon stated that he believes this the surest method of vaccinating and at the same time the patient is impressed with the fact

that he is being vaccinated with cow-pox and not inoculated with some human disease.

Dr. Chambon stated that no especial precaution is taken in the development and care of the virus during hot weather, other than cold storage at 11 degrees C.

No test for tuberculosis is made on the animals because the director does not believe it possible to transmit the disease to the human by this method.

Retrovaccination to insure the continued activity of the virus is not considered necessary. The strain is continued from one calf to another indefinitely.

No bacteriological examination is made as a routine procedure.

The animals are killed after the removal of the virus, and a post mortem examination made. If the animal is healthy, the flesh is used for food and the virus allowed to issue; otherwise not.

A general inspection of the work and premises impressed one with the fact that everything pertaining thereto was practical but that little attention was given to the strictly scientific side of the work. Ordinary cleanliness seemed to be the aim rather than strict asepsis.

BELGIUM.

Inspection of the Vaccine Institute at Brussels. March 17, 1903.
M. Degive, Director.

The institute is situated on the grounds of the "Ecole Veterinaire," and is an old one-story building with a central corridor, three rooms, and a stable, all under one roof.

In the stable was noted some stalls for the accommodation of small calves. M. Degive informed me, however, that larger animals are now used, as they are less subject to diarrhoeal trouble, afford a larger yield and he believes the vaccine is more reliable. There was one animal in the stable at the time of this inspection; a cow weighing 1,000 or 1,200 pounds and having a large well developed udder—in fact I was told that she was giving milk at the time. The stable has a cement floor, and is well drained and ventilated.

The animals are especially selected, and tested with tuberculin prior to vaccination. If a rise of one and one-half degrees C is noted the animal is rejected.

The animal is thrown by means of an especially contrived tripping arrangement on a bed of straw and fastened in such a manner as to expose the region in the neighborhood of the udder, which with the surrounding surface is carefully shaved as far forward as the umbilicus. The surface is washed with soap and water and lastly with salt solution (seven parts to the thousand).

Vaccination. The surface is vaccinated in "placques" by puncture (method to be described later). The animal is returned to the stable and fed on ordinary food, bedded with straw; while a cotton apron is placed over the scarified area immediately after vaccination.

After an interval of five days the animal is again thrown so that the vaccinated surface is exposed, when it is thoroughly washed with sterilized salt solution. A greyish white pulpy material has developed at the point of inoculation. This pulp is scraped off and put into a sterilized container, and an equal quantity of pure glycerin added, after which it is put in cold storage unground.

The animal is returned to the stable for two days longer, when it is again thrown and the redeveloped pock scraped as before. A second crop of material thus obtained is treated with glycerin as previously noted. The first gathering is believed to be the better and is used for seed, but when the virus is ready for issuance the two yields are mixed and ground, usually in a mortar, occasionally in a Chalybäas mill. The resulting material is forced through a fine copper sieve to remove hairs, large pieces of unground pulp, etc. Sufficient glycerin is now added to make the mixture equivalent to one part pulp to two parts glycerin. This material is put up in "placques" containing from one to five vaccinations each and in small vials holding twenty-five, fifty and seventy-five vaccinations.

The material is sent out with a return post card attached requesting the physician to report results.

No bacteriological test is made, nor any physiological test other than that obtained by the return card system.

Methods Peculiar to this Laboratory and Regarded by M. Degive as Essential to Successful Vaccine Production.

Perfect ventilation of the stables is a prerequisite to good vaccine production according to the director. This is attained by an especial method described as follows:

The stable is nearly square, from three sides a shaft opens near the floor and connects in a central main shaft in one side wall. About seven feet from the floor in the main shaft, gas jets are placed to assist in ventilation by drawing the heavier gases from the lower strata of air.

M. Degive's method of vaccinating requires especial notice. This is done by means of a "placque" containing thirty-two points and covering a little over one centimeter in width and about five centimeters in length. The depth of the incision is regulated by a mechanisms in the handle of the instrument. The points of the instrument are dipped into a vessel containing the seed vaccine and a series of insertions made over the udder and neighboring parts in regular rows. The punctures leave no appearance on the skin other than a light swelling and erythema. M. Degive claims that the best results are obtained by this method of vaccinating. He has secured something over 396 grams of pulp from one animal which gave one litre of finished product, sufficient for vaccinating 100,000 people. Attention, however, is called to the fact that two crops of virus are taken from each animal as before noted. This is done in no other place visited by me in Europe.

The seed used by M. Degive is obtained from cow-pox, of which there are a number of cases in the neighborhood of Brussels and which are brought to the attention of the director by the veterinarians throughout Belgium. Material from this source is added to the seed vaccine from time to time, consequently no deterioration is noted.

I was rather surprised that more care is not exercised in the production and collection of the virus. As before stated, the animal is thrown on straw in one corner of the general clinic room of the State Veterinary School. No especial precautions being taken against dust from the floor or in the air. The operating room of the laboratory proper appeared not to be in use as it was adapted only for small animals.

Great care, however, is exercised in the preparation of the virus for distribution and great stress is placed on the purifying effects of glycerin.

GERMANY.

Inspection of Vaccine Institute. Central Meat Inspection Department, Berlin. March 26, 1903. Prof. Schultz, Director.

The laboratory is located on the grounds of the Meat Inspection Department. Two buildings are used for the vaccine work. The stable and operating room occupy one, while about fifty yards dis-

tant in a small frame one-story building of two rooms, the pulp is treated after its removal from the animal.

The stable and operating room have rough walls and floors which are not adapted to thorough cleaning. In fact no especial arrangement for light, ventilation, cleaning, etc., is noted other than that found in an ordinary stable. There are six or eight stalls, each boxed in, with slat bottoms. Calves from four to six weeks old are used. They are fed on milk and eggs, five litres of milk and six eggs being allowed to each calf. Clean straw is used for bedding.

I was permitted to see the method of vaccinating which was done by lamp light at 8 P. M. The calves having been previously prepared, were strapped to a tilting table and a leather hood placed over the head and eyes. The region selected for inoculation is in the neighborhood of the udder, between the thighs and forward to the umbillicus. Only female calves are used. The area before noted is shaved, washed with soap and water, 1-1000 Bi-Chloride solution, which is carefully washed off with sterilized water and the surface dried with sterilized towels.

Linear incisions are made with an ordinary scalpel, drawing no blood. The virus is rubbed in and allowed to dry. The animals are returned to the stable where they remain for four days; they are then brought back to the operating room, strapped to the table, the surface washed carefully with soap and water forming a lather which is worked in by a brisk motion of the hand. Should any crust be present, it is removed with the finger nail. Lastly the vaccinated area is washed with sterilized water from a pitcher and dried with sterilized towels.

The pulp is removed with a sharp curette and deposited in a sterilized glass dish. The animal is killed, veterinary inspection made and if the report is favorable, the flesh is used for food and the virus takes the usual course; otherwise it is destroyed.

The pulp is taken to the second building where it is prepared by being ground in a mortar or sometimes in a Doring mill, with glycerin and water. Proportion: one part pulp to four parts of the glycerin and water mixture (glycerin 40 per cent.).

The virus is required to be held, by the German Government Regulations, for one month. If it is necessary to use it prior to this time, the proportions of the mixture are changed to one part pulp and five parts of the glycerin and water mixture. Virus thus prepared has been known to remain active for about one year; but it does not keep so well in hot weather. When ready for shipment it is put into sterilized glass cups containing from one-half c. c. to two c. c., closed with cork stopper.

Its physiological activity is determined by tests made on children.

No bacteriological examination is made as a routine procedure although exhaustive research work has been done by the German Commission, to determine the pathogenicity of the germs contained in the virus. Their results appeared to demonstrate that the contained germs were practically harmless.

Methods Peculiar to this Laboratory and Regarded by Prof. Schultz as Essential to the Successful Production of Vaccine.

Prof. Schultz believes, as do most German, that it is necessary to reinforce the activity of the lymph by retrovaccination as previously described. Human virus was inoculated on an animal during my visit; the first time for about one year. Prof. Schultz believes that the virus propagated on animals continuously, deteriorates and that its activity can be restored by this method.

Humanized lymph on a calf does not develope so rapidly as animal virus, it probably being retarded as much as twenty-four hours.

Only two attendants are necessary for the care of the stables and the preparation of virus according to Prof. Schultz method. These attendants are a man and his wife.

The vaccinating and removal of the virus is done by the director's assistant.

Prof. Schultz thought virus kept best when dry and without access to the air. He showed me a sample in the granulated form, prepared about 20 years previous.

When questioned in reference to accidents following vaccination the Director stated that these occasionally occur. He showed me photographs of Keloids, severe inflammations, hemorrhagic pustules, auto-inoculation, septic infection, Impetigo contagiosa, etc.

The general inspection of the stables and surroundings indicated that comparatively little attention is paid to asepsis and that only ordinary cleanliness is attempted.

Prof. Schultz informed me that new buildings would be shortly erected by the Government, better adapted to the work.

Inspection of the Vaccine Institute at Cologne.March 23, 1903. Edward Mader, Director.

This is a government establishment for the Province of the Rhine. The laboratory building is situated on the grounds of the Government Slaughter House and Meat Inspection Department. The build-

ing is a one-story brick with the vaccine rooms on the lower floor while part of the attic is utilized for laboratory purposes, and part as a store room. The laboratory is entered through a small vestibule, size 8 feet by 12 feet. A turn to the right through a second door leads to the stable. The stalls are arranged on either side of a central isle. These are about one dozen in number. They are built in box form with iron grating in sides and door front and back. On the bottom are wood slats raised a short distance from the floor to permit of sufficient drainage and ventilation. The stable has cement floor and is well lighted, ventilated and drained.

Adjoining the stable is the operating room, 15 feet by 20 feet, well lighted and containing several especially constructed operating tables of the tilting variety. The floor is of cement and the walls painted with white enamel paint. Further on is a small room used as an office where the virus is also prepared.

Methods of Vaccinating the Animal. Only small female calves are selected, apparently from six to eight weeks old. The calves are received on Monday, inspected and cleaned, preparatory to vaccination on Tuesday. After the animal is thoroughly cleansed, the abdominal surface from the umbilicus back between the thighs is shaved. The animal is strapped to a tilting table, the left hind leg is strapped to a perpendicular while the right remains in a horizontal position thus exposing the shaved area. The surface is carefully washed with an alkaline soap, and water (artesian but not necessarily sterile), using some friction; then dried with sterilized towels. With a platino-iridium knife, linear incisions are made about one-fourth inch apart and in all directions, ziz-zag,etc., the cutting is not deep though some little blood is drawn. This is removed with stearile pads of absorbent cotton.

Seed virus (four weeks old), is dropped on a concaved glass plate about 5 c. m. long and 1 c. m. thick. By this method it is quickly rubbed over the sacrificed area. From three to five cubic centimeters is used for each calf.

Removal of Virus. After vaccinating, the animals are placed in stalls before noted, fed on milk (about one litre daily) and carefully looked after until Friday, when they are killed and bled in the entry or vestibule before mentioned. The calf is then transferred to the operating room where the virus is to be removed. After strapping it to a table, the surface is washed with sterilized water and the vaccine taken off with a curette. This material is known as pulp and is ground in a large mortar with glycerin and water. Proportions one part pulp, one part water, and four parts glycerin. This is kept in a large cold storage room prepared for beef, in connection with the slaughter-house, at 4 degrees C. When ready for issuance it is put up in capillary tubes.

A post mortem examination is made of the animal and if found healthy, the food is used for food.

Methods Peculiar to this Laboratory and Regarded by Dr. Mader as Essential to the Successful Production of Vaccine.

Dr. Mader believes in retrovaccination in order to insure a continued efficiency of the lymph. He accomplishes this by passing seed vaccine through the child and back to the calf, two or three times a year. He claims that after virus is passed through the calf five or six times, it deteriorates so that the vaccine pustule becomes unreliable.

In Constadt, the animal lymph is propagated and has been used continuously for years without retrovaccination; but he has not been able to obtain results in this way.

No bacteriological tests are made of vaccine as a routine procedure. Dr. Mader has made occasional examinations and found organisms of the staphylococci group as well as the pseudo-diphtheria and potato bacillus. No streptococci were noted. The staphylococci are not pus-producers, but are harmless saprophytes.

No anaerobic tests are made; as Dr. Mader has no knowledge of Tetanus resulting from vaccination.

Dr. Mader states that heat ripens the vaccine vesicle rapidly and that the vaccination becomes more virulent in summer than in winter. The animals are also more frequently subject to diarrohea and he avoids producing vaccine in the summer time.

He claims that vaccine lymph may remain active for one year and produce normal vesicles in primary cases with full incision results; but in secondary vaccinations it will be weak.

He states that the inflammatory condition following the use of fresh virus is not occasioned by the impurities in the vaccine; but is due to the individual's susceptibility.

It is also to be noted that peculiar to this establishment is the incubation of three days. This is the shortest period encountered at any laboratory in Europe. I was informed by Dr. Mader that at Vienna, the incubation period is nine days from vaccination to the removal of the virus.

Inspection of the Vaccine Institute at Dresden. March 31, 1903.
Director Th. Chalybäas, M. D.

This institute consists of stable, operating room, shaving-room, bathroom for calves, and quarantine stable, all of which were in good condition and apparently well cared for.

The stable contains eight or ten stalls for small calves and three or four for larger ones. The stalls are of the box variety with walls and floor of cement. The walls are at least three inches thick. Each stall is whitewashed, and cleaned after the removal of the animal. Straw is used for bedding.

Immediately upon receipt of the animals at the stables, they are dumped by means of a sling and pulley arrangement into a large wooden tank filled with warm water. Here they are thoroughly scrubbed, green soap being freely used. They are now taken to the quarantine stable and there kept under inspection for four days. If found healthy they are shaved over the surface intended for vaccination which extends from the umbillicus back over the inside and posterior thighs.

Vaccination. The animal is placed on a tilting table, with the right hind leg well in the air. Cushions are placed under the straps to prevent compression. The shaved surface is washed with green soap and water, sterilized water and finally with alcohol. Linear incisions are then made in the long axis of the animals body, about 10 centimeters long and $1\frac{1}{2}$ centimeters distant from each other. The knife used in scarifying is charged with vaccine and occasionally the lymph is rubbed in with a pestle. After the surface has thoroughly dried, a coating of a white neutral paste (somewhat resembling oxide of zinc rubbed up in lanoline) is spread over the vaccinated area in a thin layer. In turn a thin layer of absorbent cotton is pressed tightly over this so as to take up and assimilate the paste, thus making a thoroughly homogenous covering to protect the vaccination. This covering is occasionally removed and reapplied once during the incubation period, but never oftener.

The animal is incubated for four days when it is returned to the operating room and the "Tegmen" covering removed. The surface is washed with soap and water and then thoroughly dried. The pulp is now removed with a curette and placed in a sterilized glass dish, and a glycerin and water mixture added in the proportion of one to four. This glycerin and water mixture consists of three parts glycerin and one part water.

A calf yields from one-half to twenty grams of pulp. If the vaccine is required for immediate use, it is ground several times in a Chalybäas mill until sufficiently fine; when it is put into capillary tubes holding one, five, or ten vaccinations each. The ends of these are sealed in a blast flame or with red sealing wax. The virus is usually kept for one month or longer before issuance. A post-mortem inspection of the animal is made by a competent veterinarian and the virus condemned if any disease is found.

Methods Peculiar to this Laboratory and Regarded by Dr. Chalybäas as Essential to the Successful Production of Vaccine.

Dr. Chalybäas does not propagate vaccine from May until September, since the law requires that the general vaccination be done in the spring and that of the army in the fall; the preparation of vaccine in the summer time is therefore not required.

Dr. Chalybäas does not think the size of the animal has anything to do with the reliability of the vaccine. He uses the larger animals when a large quantity of virus is required.

Attention is called to the fact that this is the only place visited where a close protection is used over the vaccinated area as previously described. This covering had been used in other places but has been abandoned. Dr. Chalybäas does not believe it interferes with the development of the vesicle; but that protects the vaccinated area from outside contaminations.

The director suggested the importance of allowing the virus to remain in cold storage for at least ten days after its admixture with glycerin, as sore arms will frequently follow its use if this caution is neglected.

He has inoculated animals with the various forms of staphylococci and found no apparent disease resulting.

He stated that practically no small-pox has existed in Germany since 1871, and that students wishing to study the disease must do so outside the Empire. This result has been obtained through the enforcement of the carefully prepared vaccination laws. A child is vaccinated soon after birth, again at eleven years of age, and the male portion of the population a third time upon entering the army.

Dr. Chalybäas kindly provided me with a copy of his last year's report to the Imperial Government. From this I will quote a few facts.

Fifty-seven thousand five hundred and eighty-two vaccinations were used from his Institute with 3 per cent. failures, 52,122 secondary vaccinations with 2.6 per cent. failures; and 5,611 soldiers with 2.74 per cent. failures. The virus was mostly from 25 to 80 days old; seldom younger than 5 days.

A total of 39 calves were used during the year. Of these 65 yielded a powerfully durable lymph; while the product from 23 was weakly and perishable. When the strain of virus runs down, humanized lymph is used to restore it to its original efficiency through the medium of retrovaccination.

Quite a little experimental work was done during the year. The director vaccinated 4 asses, 1 goat, 1 sheep and 2 horses. Varying results were obtained, mostly good. Two pigs were vaccinated but

the development of the pustule was slow and not by any means typical.

Dr. Chalybäas prepared a lymph from the inguinal and the knee joint glands of the calf triturated with pure glycerin. This he tested on a calf and found it developed slowly but at the end of seven days, was typical. This lymph was not used for vaccination purposes.

SWITZERLAND.

Inspection of the Vaccine Department of the Serum and Vaccine Institute at Berne, Switzerland. April 3, 1903.

This Institute is under State control and has for its purpose the preparation of the various serums, and vaccines, and the investigation of the contagious diseases. It is beautifully situated in the suburbs of Berne. The buildings are complete, new and well planned. The Institute is under the immediate control of Dr. Tavel; but the vaccine department is under the direction of Dr. A. Carini.

Buildings. The vaccine department occupies the ground floor of one wing of the building and consists of a bureau or office, laboratory, operating room, packing room, a preparatory room for animals and the stable.

The rooms are arranged in the form of an "L" with the operating room in the angle. The stable is at the extreme back of the short leg of the "L," and contains stalls for six animals, four large and two small. It is supplied with a ventilating and heating system for maintaining a temperature between 14 and 18 degrees C. The floor is of hard cement and can be easily cleaned. The windows are screened against flies, gnats, etc.

The operating room is large, roomy and well lighted and ventilated. The light is furnished by three windows and a skylight. The walls are covered by a porcelain plate to the height of about five feet. The floors are of corrugated cement with plenty of fall for drainage. The operating table is of the ordinary tilting variety and is of sufficient size to permit the use of larger animals. It is fastened to the floor and is operated by a cog-wheel and crank.

The laboratory adjoins the operating room in the long leg of the "L" and is finely arranged. It is easily cleaned, ventilated and supplied with an abundance of light. The table along the south wall

is covered with enamel lava plate. Water pumps, vacuum apparatus, grinding mills (of the Chalybäas pattern), and all other requirements are conveniently located.

Animals. The animals weigh from 800 to 900 pounds and at the time of this inspection, cows with large udders and apparently giving milk, were in the stable. The animals are held in quarantine for preliminary inspection and the tuberculin test, before admission to the stable.

Before entering the stalls they are carefully washed, the feet particularly being bathed in an antiseptic solution. They are then placed on the table exposing the inguinal and abdominal region, and shaved around the udder, and forward on the abdomen to immediately back of the front legs. The surface is washed with soap and water, followed by sterilized water then dried. Linear incisions are made in the direction of the long axis of the animal, about 1 c. m. apart. The seed vaccine is rubbed into each cut with a blunt spatula, the vaccinated surface covered with a cloth resembling an apron and the animal taken to the stable. Formerly the "tegmen" covering (according to the Chalybäas method) was used but has been abandoned.

During the incubation period, the animal is carefully watched, its temperature taken night and morning, the stalls thoroughly cleaned daily; and in summer should the vesicles during their development become dry and cracked instead of proceeding normally, an 80 per cent. solution of glycerin and water is rubbed gently over the surface once daily.

The incubation period is from five to six days according to the development of the pock. The animal is returned to the operating room the surface washed carefully with soap and water for a longer or a shorter period to remove the scab and foreign material; next douched with sterilized water and dried with sterile cotton sponges. The vesicles and their contents are then removed with a curette, taking as little blood as possible. The virus is prepared by an admixture of an 80 per cent. solution of glycerin and water in proportions as follows: one part pulp and three parts of the glycerin mixture. This is thinned again for local distribution.

The material is tested at intervals both bacteriologically and on the animal. It is not allowed to issue until practically free of bacteria except for export. When required for this purpose, it is sent out in from ten to fifteen days or as soon as the test shows it to be active and the veterinary report has been received.

The vaccine is put up in capillary tubes holding from three to five vaccinations; also in small vials of 25, 50 or 100 vaccinations each. The material is not immediately ground after its removal but is

covered with glycerin and placed in cold storage until required for use.

It was the opinion of the director, that severe inflammatory conditions follow the use of fresh vaccine but when held sufficiently long to destroy the bacteria, no such results are anticipated.

No antiseptics are used in any part of the work but cleanliness is insisted upon and an inspection of every department showed evidence of great care in the production and preparation of the virus. The instruments are kept in a saturated solution of Boracic acid when not in use.

Methods Peculiar to this Laboratory and Regarded by Dr. Carini as Essential to the Successful Production of Vaccine.

Only large animals are used here, though no especial reason was given as to their preference to the smaller ones.

Especial attention is called to the bacteriological work both routine and experimental. Staphylococcus Aureus and Citreus are found in the virus. Occasionally streptococcus, which is not virulent, pseudo-diphtheria, colon, and hay bacilli are also noted.

The director was particularly emphatic regarding the destroying action of heat on the vaccine. He states that vaccine exposed for one day to incubation temperature (37 degreesC) would show evidence of deterioration.

Inspection of the Vaccine Institute. Lausanne, Switzerland. Directors, E. Felix and J. Flück.

This Institute is finely situated on the mountain side overlooking the city of Lausanne, probably 1,000 feet above Lake Geneva and connected with the town by a well kept winding road. The surroundings are ideal for the successful propagation of vaccine. M. Flück speaks English fairly well and has charge of the business of the Institute. M. Felix, personally, superintends the laboratory work. The Institute is the private property of the two gentlemen; but is under State control.

There is but one building which is constructed in the form of a rectangle and contains all the departments. The front entrance and stable occupy the extremes of the building and are connected by a central hallway with the reception room; office; director's room; pulp grinding room, or laboratory room, and operating room, arranged on either side. The floors of the operating room and stable are of

cement, well arranged for cleaning and drainage. The stalls are of the box variety with movable slat bottoms. Small calves from one to two months old are used; though arrangements have recently been made to propagate virus from larger animals. This is because calves are difficult to secure and also because the yield from a larger animal is greater and thought to be more reliable during the summer heat.

The animals are kept in quarantine from three to five days prior to vaccination. The tuberculin test is not employed. When taken from quarantine, the abdominal surface is shaved from back of the fore legs to between the thighs but not on the posterior thighs. The animal is strapped to the tilting table and the shaved surface washed with one per cent. lysol solution. This is washed off with sterilized water and dried with sterilized towels. With a lancet, incisions are made about 10 centimeters long and about 1½ centimeters distant from each other. No blood is drawn. The seed vaccine is worked into each cut separately and the animal taken to the incubation stable. It remains here for from four to six days and is fed on sterilized milk and eggs.

An inspection of the vesicle determines the proper time for its removal. The animal is taken to the operating room and the surface washed with a stiff brush, soap, and water, for about ten minutes to remove the crust. The vesicles are then removed with a peculiar curette having a bowl about three centimeters long and one centimeter wide. The pulp is mixed with an equal quantity of glycerin by weight. The animal is killed and a postmortem examination made and report submitted as to the animal's health.

The vaccine is kept in glycerin two or three weeks when it is tested on calves; also on children at the poly-clinic at Lausanne. A sample of each lot is also submitted to the city bacteriologist and the virus is not used until his report has been received.

When ready for issuance, another volume of 60 per cent. glycerin is added after the grinding. For export vaccine, only the first dilution is used and when intended for this purpose it is shipped as soon after collection as possible without waiting for a bacteriological report. The virus is put up in capillary tubes for shipment. Each animal yields an average of 60 grams of pulp. In the summer the quantity is less and the quality poorer. About 6 per cent. of the animals fail to take at this season.

Methods Peculiar to this Laboratory and Regarded by M. Felix as Essential to the Successful Vaccine Production.

It may be noted that probably more care is taken from an asceptic as well as a bacteriological standpoint at this Institute than at any other visited in Europe with the possible exception of the Institute of the Local Government Board in London.

The grinding of the virus is done in a mill which is a modification and an improvement of the Chalybäas pattern. The inside cylinder of this is conical in shape and about two inches in diameter at the largest part. This is driven by machinery under the table instead of on top and thereby the possible contamination of the virus is more easily prevented.

ITALY.

Inspection of the Vaccine Institute at Rome, via Fario N. 62 April, 1903. Director, Prof. Otavio Leoni.

This is one of the oldest vaccine institutes in Enrope, having been established in 1864, shortly after the adjournment of the Lyonese Commission. It was formerly a State institution but is now the private property of the director, under State control.

The entrance to the laboratory is made through the characteristic "porter lodge" and "inner court" peculiar to Rome. The rooms are all on the ground floor. An entrance is effected through the office to the laboratory and room for the preparation of the vaccine. Adjoining this is the stable, wash room, etc. The rooms are poorly lighted and ventilated though the surroundings are kept as clean as possible under the circumstances.

Small calves from six to eight months old are used. No especial breed is selected. No preliminary tests are made for tuberculosis, since according to the director, the disease does not exist in the Campania where the animals are procured.

The animals are kept in quarantine for three or four days after which they are well groomed though not washed or subjected to other preliminary treatment. When ready for vaccination, the surface is shaved over the abdominal region, washed with soap and water and again with equal parts water and 95 per cent. alcohol. The linear incisions are made in groups as per diagram:
about 10 centimeters long and from 2 to 3 millimeters distant from each other. These are made over the whole surface intended for vaccination. The animal is not incubated for any definite time; but the rémoval of the virus is determined by the development of the vesicle. Four, five or six days may be required. An inspection is made twice daily and the virus removed when the desired condition is reached.

Removal of the Virus. The surface is thoroughly cleaned after which each group is seized in turn at the base of the vesicles with an especial pair of forceps and the vesicles and their contents scraped off with a curette. The material thus obtained is ground in a mortar and forced through a copper sieve to remove scab, hair, crust, etc. This vaccine is mixed with an equal quantity of glycerin solution prepared as follows: two parts glycerin and one part sterilized water. The vaccine is not allowed to issue for one month or until such a time as it is practically free of extraneous contamination.

Methods Peculiar to this Laboratory and Regarded by Prof. Leoni as Essential to the Successful Production of Vaccine.

Prof. Leoni claims to have been the first to demonstrate the fact that glycerin destroys the extraneous organisms in vaccine with little or no detriment to the activity of the virus. His research along this line was begun in December, 1888, when he found that fresh vaccine prepared by the older methods almost invariably produced a sore that was not always typical and at times not protective. He also noted that some forms of the Pyogenes were universally present in fresh virus and by his experiments he showed that these germs gradually disappear in the glycerin emulsion. His observations were published in 1890 as a memorandum. Copeman's first works along this line and embodying similar views was published in 1891. It therefore appears that to Prof. Leoni is due the credit of first having demonstrated that glycerin destroys the extraneous germs found in vaccine; at the same time preserving its activity.

No tetanus has ever been discovered in vaccine though repeated anaerobic tests have been made. The director regards such tests as having practically no value as routine procedure.

Prof. Leoni stated that considerable trouble is experienced in producing vaccine in the summer time. He further stated that he had experienced trouble in shipping virus during the heated term without destroying its activity. When such consignments are made, the activity of the virus cannot be guaranteed unless it is shipped in a refrigerator. He has tried many times to send it to Africa but found it to be inactive when it reached its destination. This year he shipped a consignment to Ethopia where they intend to make an attempt to propagate vaccine since no reliance can be placed on the virus received from Italy.

Prof. Leoni does not believe it necessary to reinforce the activity of the virus in any way. His present strain has been in existence since 1894. It came originally from cow-pox and since then has passed through 1,600 calves.

In conclusion, we could not help feeling that the work done here is creditable and conscientiously carried out, though the director appeared to be handicapped by his surroundings. The results, however, are such as would be expected from so celebrated a scientist as Prof. Leoni.

COMMONWEALTH OF PENNSYLVANIA.

STATE BOARD OF HEALTH.

REPORT OF DR. W. F. ELGIN

OF INSPECTION OF

VACCINE PROPAGATING ESTABLISHMENTS

IN EUROPE.

(Extracted From the Twentieth Annual Report of the State Board of Health.)

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA,
1904.